PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:

David A. FORD et al.

Application No.: 09/859,532

Filed: May 18, 2001

Docket No.: 109528

For: SINGLE CRYSTAL SEED ALLOY

BRIEF ON APPEAL

Appeal from Group 1700

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I. INTRODUCTION

This is an appeal from an Office Action mailed February 19, 2003 finally rejecting claims 1-5 and 7-20 of the above-identified patent application. No claims are allowed.

A. Real Party-in-Interest

The real party-in-interest for this appeal in the present application is Rolls-Royce PLC, by way of an assignment recorded in the U.S. Patent and Trademark Office at reel 012165, frame 0338.

B. Statement of Related Appeals and Interferences

There are presently no appeals or interferences, known to Appellant, Appellant's representative, or the Assignee, which will directly affect or be directly affected by or have a bearing upon the Board's decision in the pending appeal.

C. Status of Claims

Claims 1-5 and 7-20 are pending. Claims 1-5 and 7-20 are finally rejected and are on appeal. Claims 1-5 and 7-20 are set forth in the attached Appendix. Claims 1, 10, 13, 18, 19 and 20 are independent. Claims 2-5, 7-9, 1-12 and 14-17 directly or indirectly depend from claim 1.

D. Status of Amendments

An Amendment After Final Rejection was filed on June 19, 2003, and was entered by the July 7, 2003 Advisory Action. Accordingly, all of the requested amendments have been entered, and are reflected in the attached Appendix.

II. THE INVENTION

The claimed invention is directed to a metal alloy composition. The alloy composition provides significant advantages not realized in the prior art such as an improved seed crystal for single crystal casting. The claimed metal alloy seed crystal improves the casting of nickel-based superalloys. (Specification, page 2, lines 16-31).

Nickel-based superalloy production used in, for example, turbine blades, requires a crystal structure aligned in a preferred direction. One established practice utilizes a seed crystal having the required crystal structure to initiate superalloy crystal formation in the desired orientation. Solidification of the superalloy then occurs by epitaxial growth in which the molten superalloy solidifies directly from a partially melted seed crystal made from the same or an equivalent superalloy as the cast component. (Specification, page 1, lines 25-31). One drawback encountered with this known method is that the seed crystals, when partially melted, generate unwanted oxide films that interrupt the epitaxial growth of the single crystal. As a result, secondary crystals form in the superalloy that solidify in randomly distributed atomic orientations. (Specification, page 1, line 35 to page 2, line 6).

A further difficulty arises from the wide solidification temperature range of the seed alloy (for example, a range greater than 50°C). Alloys that have a wide solidification temperature range tend to form large "mushy" zones during solidification (i.e., a zone in which liquid and solid phases coexist). This interrupts the epitaxial growth of the single crystal and further encourages the formation of random secondary crystal growth. (Specification, page 2, lines 8-14).

Applicants' alloy overcomes these problems. First, the claimed seed alloy does not contain any component that forms an oxide layer at the solidification temperature. Therefore, the claimed seed alloy eliminates the oxide film produced under the directional solidification conditions used for superalloy casting. As a result, uninterrupted epitaxial growth of a single crystal occurs. (Specification, page 2, lines 20-25).

Second, the claimed alloy composition provides a narrow solidification temperature range. As a result, a seed alloy produced from the claimed composition does not form a mushy zone during solidification, reducing the potential for secondary crystal nucleation and further enhancing the uninterrupted epitaxial growth of single crystals during solidification.

(Specification, page 2, lines 27-31). The claimed seed alloy enhances the results and reduces the rejection rate of single crystal alloy castings.

Claim 1 is directed to an aluminum-free single crystal seed alloy composition comprising nickel and 5 to 50 weight % of a further metal selected from the Transition Series of elements in Period VI of the Periodic Table.* Claims 13 and 19 are directed to an aluminum-free single crystal seed alloy composition consisting essentially of nickel and 13 to 45 weight % of tantalum (claim 13) or 5 to 50 weight % of tungsten (claim 19).

III. THE APPLIED REFERENCES

The applied references are U.S. Patent No. 4,900,394 to Mankins (hereafter, "Mankins"); U.S. Patent No. 4,707,192 to Yamazaki et al. (hereafter, "Yamazaki"); U.S. Patent No. 4,764,225 to Shankar et al. (hereafter, "Shankar"); and ASM Handbook Vol. III (hereafter, "ASM").

IV. ISSUES

The issues on appeal are:

1) whether claims 1, 3-5, 7, 11, 14 and 19 are anticipated under 35 U.S.C. §102(b) over Mankins,

2) whether claims 2 and 8-10 would have been obvious under 35 U.S.C. §103(a) over Mankins in view of ASM;

3) whether claims 12 and 20 would have been obvious under 35 U.S.C. §103(a) over Mankins in view of Yamazaki;

4) whether claims 15-17 would have been obvious under 35 U.S.C. §103(a) over Mankins in view of Shankar; and

* The Transition Series elements in Period VI are elements 57-79 and includes for example: hafnium (Hf), tantalum (Ta), tungsten (W), rhenium (Re), osmium (Os), iridium (Ir), platinum (Pt), and gold (Au).

5) whether claims 13 and 18 would have been obvious under 35 U.S.C. §103(a) over Mankins in view of Shankar and ASM.

V. GROUPING OF CLAIMS

Each claim of this patent application is separately patentable and upon issuance of a patent will be entitled to a separate presumption of validity under 35 U.S.C. §282. For convenience in handling of this appeal, the claims are grouped and argued as follows:

Group I - claims 1-5, 7-11, 14 and 19;

Group II - claims 13, 15-18; and

Group III - claims 12 and 20.

Thus, pursuant to 37 C.F.R. §1.192(c)(7), in this appeal, the claims within each group will stand or fall together, but the groups of claims do not stand or fall together.

VI. ARGUMENTS

A. Mankins Does Not Anticipate the Claimed Alloy

Claims 1, 3-5, 7, 11, 14 and 19 are rejected by the Examiner as being anticipated under 35 U.S.C. §102(b) over Mankins. Because Mankins does not disclose the claimed invention of at least Groups I and II, Mankins does not anticipate the claimed invention. The rejection should thus be reversed.

1. A genus does not necessarily anticipate every single species

In order to anticipate under 35 U.S.C. §102 a prior art reference must teach each and every feature set forth in the claim such that one of ordinary skill could practice the invention. An anticipatory reference must describe the patented subject matter with sufficient clarity and detail to establish that the subject matter existed and that its existence was recognized by persons of ordinary skill in the field of the invention. ATD Corp. v Lydell, Inc., 159 F.3d 534 (Fed. Cir. 1998).

While case law firmly establishes that a claim to an earlier species anticipates a later genus claim limitation, Eli Lilly & Co. v. Barr Labs, Inc., 251 F.3d 955, 971 (Fed. Cir. 2001), *cert denied,* 122 S. Ct 913 (2002); Brown v. 3M, 265 F.3d 1349 (Fed. Cir. 2001), the law is equally clear that the earlier disclosure of a genus does not necessarily anticipate every species member of the genus. Bristol-Myer-Squibb Co. v. Ben Venue Labs, Inc., 246 F.3d 1368, 1380 (Fed. Cir. 2001). Beginning at least with In re Petering, 133 USPQ 275, 279 (CCPA 1962), for example, the courts have held that a generic formula encompassing a number of compounds does not necessarily describe a later claimed species encompassed by the generic disclosure.

The court in Petering noted that a prior art reference generically describing thousands of compounds does not automatically anticipate any species within that genus. The prior art reference broadly described a vast number of compounds but also disclosed a "pattern of preferences" that essentially limited the class to some twenty compounds, the members of which were very similar to one another in structure and all of which possessed the same properties. Thus, the reference anticipated a species falling within this much more limited class.

The court again addressed this issue in In re Ruschig, 343 F.2d 965 (CCPA 1965). Following similar reasoning set forth in Petering, the court in Ruschig held that claims to a species of compounds were not anticipated when the prior art examples disclosed about one hundred compounds that were not closely related, provided widely differing choices, and had diverse properties.

Following the decisions in Petering and Ruschig, the courts have decided a number of cases that further clarify the scope of generic teachings in the prior art for §102 purposes. For example, the court has repeatedly emphasized the need for disclosed preferences or exemplary enumeration to narrow a generic teaching to a sufficiently small number of closely

related compounds to support a §102 rejection. See, In re Schaumann, 572 F.2d 312 (CCPA 1978); In re Kollman, 201 USPQ 193 (CCPA 1979); In re Sivaramakrishnan, 213 USPQ 441 (CCPA 1982). Mankins does not provide such narrow teachings.

Mankins describes a process for reportedly producing a single crystal object made of gamma prime strengthened nickel-base alloy (col. 2, lines 3-6). The method involves fusion welding a single crystal seed object to an alloy mass and zone annealing to epitaxially grow a single crystal from the welded joint into the alloy mass (col. 2, lines 15-18). From the disclosure, it appears that the Mankins process suffers from the problems described above in Section II, namely, the generation of oxide films and a wide temperature range (i.e., mushy zones) that allow for random secondary crystal formation. Mankins fails to recognize, and therefore contains nothing to address, these problems.

Mankins uses a crystal seed alloy produced from a variety of materials (col. 3, lines 27-29). Mankins' crystal seed can be an ODS alloy of the composition shown in Table I (col. 3, lines 29-32) or it can also be "any nickel base alloy having lattice parameters which closely match the lattice parameters of the ODS alloy," (col. 3, lines 32-35). In the latter case, Mankins discloses alloy compositions that fall within the limits of one or more of the ingredient ranges set forth in Table II.

Mankins thus teaches potential crystal seed alloys compositions dictated by the list of ingredients and ranges set forth in Tables I and Table II. Tables I and II in Mankins include at least sixteen possible ingredients such as Cr, Al, Ti, Mo, W, Nb, Ta, C, Zr, B, Co, Hf, Re, Y, V and Ni. Other than their potential use in metal alloys, these elements share no common characteristics recognizable by one of ordinary skill in the art. The sixteen elements perform a variety of functions in nickel-base alloys. For example, Cr acts to improve the sulfidation resistance of the alloy. C acts to form carbides, and Mo acts to precipitate carbides in the grain boundary, thus strengthening the grain boundary. Zr and B segregate in the grain

boundary and act to increase the grain boundary strength at high temperatures. Co dissolves in the gamma phase and gamma prime phase and contributes to solid solution strengthening. Y disperses uniformly in the base alloy and increases the creep rupture strength at high temperatures. From this extensive list, only W and Ta are Period VI, Transition Series elements. W and Ta are normally included in nickel based superalloys to strengthen and improve the ductility of the gamma prime phase.

Not only do Tables I and II disclose a wide variety of unrelated elements but Mankins also teaches that each element can be included in a broad concentration range. For example, Mankins teaches that the seed alloy can contain 6-26 wt % Cr; 5-10 wt % Al + Ti; 0-12 wt % W; 0-12 wt % Ta, etc. Mankins provides some guidance in the form of preferred ranges for each alloy ingredient. For instance, Mankins prefers 12-20 % Cr, 6-9 % Al + Ti, 0-5% W and 0-6 % Ta, etc. (See, Tables I and II).

As detailed above, instant claim 1 (Group I) is directed to an aluminum-free alloy composition comprising nickel and 5 to 50% of a Period VI Transition Series element. Removing aluminum from the alloy composition reduces or eliminates the generation of unwanted oxide films in a partially molten seed crystal (specification, at page 3, lines 6-9). Mankins does not teach the features of claim 1. While Mankins discloses an alloy composition that potentially contains a variety of ingredients, Mankins fails to recognize the benefit of an aluminum-free alloy. From the extensive list of ingredients shown in Tables I and II, Mankins indicates only in Table II a potential and non-preferred range of 0-10 wt % Al + Ti. Contrary to the Office Action's position, however, Mankins does not teach, and in fact expressly teaches against, an aluminum-free alloy.

Beginning at col. 3, line 66, Mankins discloses the preparation of a superalloy object (11) and crystal seed (12). Mankins describes grinding the faying faces (13 and 14) and then cleaning the faces "to remove contaminants, e.g., oxides and carbides." Accordingly,

Mankins indicates that its seed alloy contains elements that generate oxide films, such as Al and Ti. Beyond the single 0-10 wt % Al + Ti range referenced in Table II, Mankins fails to provide any indication or any teaching of a 0 wt % Al (i.e., aluminum-free) crystal seed alloy. The composition taught by Mankins in Tables I and II constitute a broad, and almost infinite disclosure of potential alloys that cannot anticipate any specific compound.

The significance of Mankins' failure to expressly highlight an aluminum-free alloy is significant to an analysis of anticipation under 35 U.S.C. §102. The description of "specific references in connection with the generic formula" is determinative in an analysis of anticipation under 35 U.S.C. §102. In re Petering, 301 F.2d 676, 681, 133 USPQ 275, 279 (CCPA 1962). For example, the court recognizes that "the disclosure of a chemical genus . . . constitutes a description of a specific compound" within the meaning of §102(b) when the specific compound falls within the ambit of a "very limited number of compounds." In re Schaumann, 572 F.2d 312, 315, 197 USPQ 5, 8 (CCPA 1978). Mankins does not teach a limited number of alloy compositions.

Mankins discloses thousands of possible alloy compositions. Furthermore, there is no indication in Mankins that an aluminum-free composition is preferred. Thus, Mankins does not teach a person of ordinary skill in the art that an aluminum-free single crystal seed alloy composition comprising nickel and 5-50 weight % of a Period VI transition series element would be preferable to any other possible combination. Mankins does not describe or forecast the effects that an aluminum-free crystal seed alloy would have on maintaining the single crystal properties of the superalloy, nor does Mankins teach or suggest the exploration of combinations of the various elements, nor does it teach the specific ratios of the combinations as recited in claim 1.

The teachings of Mankins constitute a "shotgun" disclosure of possible metal alloys that cannot anticipate the specific claimed alloy. The court has held that a reference's listing

of compounds within the scope of a claim "constituted nothing more than speculation about their potential or theoretical existence" and, hence, was not a description of the compounds within the meaning of §102(b). In re Wiggins 488 F. 2d 538, 543 179 USPQ 421, 425 (CCPA 1973). Moreover, Mankins fails to include any exemplary enumeration of alloy compositions to narrow the generic teaching of compositions to a number sufficiently small to support a §102(b) rejection under the rationale of in re Petering, in re Schaumann, and related cases.

Mankins teaches thousands of potential alloy compositions containing the elements listed in Tables I and II in various combinations. Furthermore, there is an almost limitless number of alloy compositions within the ranges disclosed in Mankins. There is nothing in Mankins to teach or suggest which, if any, of the compositions within the ranges teach the limitations of claim 1. Accordingly, Mankins could not have directed one of ordinary skill in the art to create an aluminum-free single crystal seed alloy composition within the scope of claim 1.

2. Mankins does not describe the claimed alloy composition

The anticipation rejection over Mankins incorrectly presumes that Mankins' listing of 0-10 % Al + Ti in Table II constitutes a description of the claimed invention (i.e., aluminum-free) within the meaning of §102. However, Mankins' listing of 0-10 % Al + Ti in Table II does not constitute a description of an aluminum-free alloy composition.

The mere naming of a compound in a reference, without more, does not constitute a description of the compound. In re Wiggins, 488 F. 2d 538, 543 179 USPQ 421, 425 (CCPA 1973). In Wiggins, the Patent Office rejected claims directed to compounds useful for treating Parkinson's disease, under §102. The prior art reference reported the synthesis of a numbers of compounds and studies of their effects. However, none of the reference compounds actually prepared and studied fell within the scope of the claims and the reference

mentioned by name only two compounds that did. The court in Wiggins held that a §102 rejection was improper. In the court's view, the reference by itself did not disclose all that is necessary to put the compounds in the hands of the public. The reference's listing of the compounds by name only constituted nothing more than speculation about their potential or theoretical existence. The court stated, "the mere naming of a compound in a reference, without more, cannot constitute a description of the compound." The court further stated, "if we were to hold otherwise, lists of thousands of theoretically possible compounds could be generated and published which . . . would bar a patent to the actual discover of a named compound no matter how beneficial to mankind it might be. . . . Therefore we hold that the compounds named in [the prior art] and within the scope of the claims in issue were not 'described in a printed publication' as meant by the applicable portion of §102(b)." Id.

In order to anticipate, a reference must sufficiently describe the claimed invention to have placed the public in possession of it. Minnesota Mining and Manufacturing v. Johnson & Johnson, 976 F.2d 1559 (Fed. Cir. 1992). Mankins does not place the public in possession of the claimed alloy composition. In Minnesota Mining, claims to an orthopedic casting material comprising a fabric impregnated with a polymer, having a particular modulus of elasticity, thickness, and mesh size, were not anticipated by the prior art's generalized disclosure of knit fiberglass as a substrate. The court pointed out that the prior art did not identify the claimed ranges of elasticity, thickness and mesh size. The court recognized that although the patent claims were subsumed in the reference's generalized disclosure, this is not literal identity necessary for a rejection under §102.

In Ultradent Products, Inc. v. Life-Like Cosmetics, Inc., 127 F.3d 1065 (Fed. Cir. 1997), claims to a composition containing 3% and 5% of a compound were not necessarily anticipated by the prior art's disclosure of compositions containing 0.05% to 5% of that compound. The court held that in order to anticipate the claimed composition, the prior art

must "describe to one of skill in the art . . . combinations meeting the limitations of the claims from among the many possible combinations." Id., at 1072. The court noted that there were thousands of possible combinations of formulations disclosed in the prior art reference and that the reference contained nothing to suggest which, if any, of the compositions within the taught ranges satisfy the claim limitations. Like the situations in Minnesota Mining and in Ultradent, any possible alloy composition described in Mankins that potentially falls within the scope of the patent claims in issue was not "described in a printed publication" as meant by this portion of 35 U.S.C. §102.

In determining the scope of a reference's disclosure, the court will often turn to the standards of 35 U.S.C. §112, first paragraph for helpful guidance. It is well established that to satisfy the written description requirement of §112, the disclosure needs to reasonably convey to persons skilled in the art that the inventor had possession of the subject matter in question. Fujikawa v. Wattanasin, 93 F.3d 1559, 1570 (Fed. Cir. 1996).

In Fujikawa, the issue involved whether a patent's specification provided adequate support for adding a sub-genus count to an interference proceeding. The court recognized that the patent disclosed a genus of compounds but the question was whether Wattanasin's application provided adequate direction which reasonably would lead persons skilled in the art to the sub-genus of the proposed count. The court in Fujikawa acknowledged the standards graphically articulated in In re Ruschig, analogizing a genus and its constituent species to a forest and its trees:

> It is an old custom in the woods to mark trails by making blaze marks on the trees. It is no help in finding a trail . . . to be confronted simply by a large number of unmarked trees. Appellants are pointing to trees. We are looking for blaze marks which single out particular trees. We see none.

In re Ruschig, 379 F.2d 990, 994-995, 154 USPQ 118, 122 (1967).

The court in Fujikawa recognized that the compounds of the proposed sub-genus were not Wattanasin's preferred and that his application contained no blaze marks as to what compounds, other than those disclosed as preferred, might be of special interest. The court held that in the absence of such blaze marks, simply describing a large genus of compounds is not sufficient to satisfy the written description requirement as to particular species or sub-genuses. Fujikawa, 93 F.3d 1559 at 1571. The court again cited Ruschig for stating, "[S]pecific claims to single compounds require reasonably specific supporting disclosure and while . . . *naming* [each species] is not essential, something more than the disclosure of a class of 1000, or 100, or even 48 compounds is required." Id., quoting Ruschig 379 F.2d at 994, 154 USPQ at 122. The Fujikawa court continued;

> "[J]ust because a moiety is listed as one possible choice for one position does not mean there is *ipsis verbis* support for every species or sub-genus that chooses that moiety. Were this the case, a "laundry list" disclosure of every possible moiety for every possible position would constitute a written description of every species in the genus. This cannot be because such a disclosure would not 'reasonably lead' those skilled in the art to any particular species."

Fujikawa, 93 F.3d 1559 at 1571.

Just like Ruschig and Fujikawa, Mankins does not provide adequate support for every species within its broadly disclosed "laundry list" of alloy compositions. Mankins' listing of 0-10% Al + Ti in Table II as a possible component to an alloy generated for fusion welding and zone annealing constitutes nothing more that speculation about its potential or theoretical usefulness. Although Mankins lists thousands, perhaps an infinite number, of compositions without providing a single example to guide the public. The only potential blaze marks, i.e.,

Mankins' preferred alloy compositions, actually direct the public to an aluminum alloy, and not an aluminum-free alloy as claimed.

3. Conclusion

For all of the reasons discussed above, Mankins does not teach or suggest an aluminum-free single crystal seed alloy composition comprising nickel and, in the proportion of 5 to 50 weight %, a further metal selected from the Transition Series of elements in Period VI of the Periodic Table of elements as claimed. Mankins' broad disclosure of alloy compositions constitute nothing more than a laundry list disclosure that would not have led one of ordinary skill in the art to the claimed composition. Mankins does not recognize the problems created by an oxide film, nor does Mankins offer any suggestion for eliminating the film. Mankins expects the alloy to include an oxide film and describes additional steps that must be performed in order to use the alloy as a crystal seed. Moreover, Mankins teaches away from the claimed alloy by disclosing a clear preference for including aluminum as shown in Tables I and II.

It is respectfully submitted that claims 1, 3-5, 7, 11, 14 and 19 define patentable subject matter under 35 U.S.C. §102(b) over Mankins and are thus in condition for allowance.

B. <u>Mankins & Yamazaki, and Mankins & Shankar Would Not Have Rendered Obvious the Claimed Alloy Composition</u>

Claims 2, 8-10, 12, 13, 15-18 and 20 (Groups II and III) are variously rejected under 35 U.S.C. §103(a). In particular, claims 2 and 8-10 are rejected over Mankins in view of ASM, claims 12 and 20 are rejected over Mankins in view of Yamazaki, claims 14-17 are rejected over Mankins in view of Shankar, and claims 13 and 18 are rejected over Mankins in view of Shankar and ASM. However, just as Mankins does not disclose the claimed invention, Mankins combined with any of the secondary references would not have rendered obvious the claimed invention. The rejections should thus be reversed.

1. None of the cited references teach or suggest an aluminum-free alloy composition

All of claims 1-5 and 7-20 (Groups I-III) are directed to an aluminum-free single crystal seed alloy composition. As detailed in the above remarks, Mankins does not teach an aluminum-free alloy composition. The secondary references, Yamazaki, Shankar and ASM do nothing to remedy the failed teachings of Mankins.

Yamazaki discloses an alloy composition that includes 4.5-6 % aluminum (col. 3, lines 11-49). Yamazaki further discloses that aluminum is an essential element for the formation of the alloy's gamma prime phase (col. 4, lines 7-10). Yamazaki fails to disclose anything that would have taught or suggested an aluminum-free alloy. For at least this reason alone, Mankins and Yamazaki do not teach or suggest an aluminum-free alloy composition as claimed.

Shankar describes a nickel-based alloy that includes up to about 10 % aluminum (Abstract). Shankar's preferred composition includes 3-7% aluminum (col. 3, line 54-55) and the reference exemplifies compositions that include 0.5-7 % aluminum (Table). Like Yamazaki, Shankar fails to disclose anything that would have taught or suggested an aluminum-free alloy. For at least this reason alone, Mankins and Shankar do not teach or suggest an aluminum-free alloy composition as claimed.

2. Yamazaki does not teach or suggest an alloy having 13-40 % tungsten

Claims 12 and 20 (Group III) are directed to an aluminum-free alloy composition that includes 13-40% tungsten. Yamazaki, alone or in combination with Mankins, does not teach the claimed alloy.

In addition to teaching an aluminum alloy, Yamazaki discloses the inclusion of tungsten to strengthen the alloy's gamma phase and gamma prime phase. However, in order to do so, tungsten must dissolve in the gamma and gamma prime phases. Excess or

undissolved tungsten leads to the formation of deleterious precipitates, thus shortening the alloy's creep rupture life (col. 4, lines 1-6). Aluminum is essential to the formation of the gamma prime phase (col. 4, lines 7-8). Since the claimed alloy is aluminum-free, one of ordinary skill in the art would expect such an alloy to lack a gamma prime phase and would not have been motivated to include any tungsten to the alloy, let alone the claimed 13-40 % tungsten.

For this additional reason, Mankins and Yamazaki would not have taught or suggested to one of ordinary skill an aluminum-free single crystal seed alloy composition that includes 13-40 weight % tungsten as claimed.

3. Shankar does not teach or suggest an alloy having 13-50% tantalum

Representative of Group II, claim 15 is directed to an aluminum-free alloy composition that includes 13-50% tantalum. Shankar, alone or in combination with Mankins, does not teach the claimed alloy.

The Office Action states that Shankar teaches the addition of up to 30 weight % of any one of a group of elements, including tantalum. In fact, Shankar describes an alloy that includes up to about 30 % in combination of elements from the group tantalum, tungsten, molybdenum, columbium, rhenium and vanadium (Abstract). However, nowhere does Shankar teach or suggest 30 % tantalum or even 13 % tantalum as claimed.

The described 30 % metal pertains to the combination of elements from the group tantalum, tungsten, molybdenum, columbium, rhenium and vanadium. Shankar further discloses in more detail that its alloy composition includes 3-10 % of any one member from this group (col. 3, line 56 to col. 4, line 3). Shankar specifically exemplifies alloy compositions that include 2.5-8 % tantalum (Table). Nowhere does Shankar disclose

anything that would have taught or suggested to one of ordinary skill in the art the addition of 13-50 % tantalum to an aluminum-free alloy composition as claimed.

For this additional reason, Mankins and Shankar would not have taught or suggested to one of ordinary skill in the art an aluminum-free single crystal seed alloy composition that includes 13-50 weight % tantalum as claimed.

VII. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that claims 1-5 and 6-20 define patentable subject matter under 35 U.S.C. §102(b) over Mankins and under 35 U.S.C. §103(a) over Mankins, Yamazaki, Shankar and ASM, and are thus in condition for allowance.

For all of the above reasons, appellants respectfully request this honorable Board to reverse the rejections of claims 1-5 and 7-20.

Respectfully submitted,

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Enclosure:
Appendix A

APPENDIX A

CLAIMS:

1. An aluminum-free single crystal seed alloy composition comprising:

nickel; and,

in the proportion of 5 to 50 weight % a further metal selected from the Transition Series of elements in Period VI of the Periodic Table of elements.

2. A single crystal seed alloy composition as claimed in claim 1, which alloy composition has a solidification temperature which is not less than 1300°C and not greater than 1400°C.

3. A single crystal seed alloy composition as claimed in claim 1 consisting essentially of nickel and the further metal.

4. A single crystal seed alloy composition as claimed in claim 1, wherein the further metal is present in the range 13 to 50 weight %.

5. A single crystal seed alloy composition as claimed in claim 1, wherein the alloy composition forms substantially no oxide layer when molten.

6. (Canceled)

7. A single crystal seed alloy composition as claimed in claim 1, which alloy composition contains no titanium.

8. A single crystal seed alloy composition as claimed in claim 1, wherein the alloy has a solidification temperature range not greater than 50°C.

9. A single crystal seed alloy composition as claimed in claim 8, wherein the alloy has a solidification temperature range not greater than 20°C.

10. An aluminum-free single crystal seed alloy composition comprising:

nickel; and

in the proportion of 5 to 50 weight % a further metal selected from the Transition Series of elements in Period VI of the Periodic Table of elements,

wherein the alloy composition has a solidification temperature which is not less than 1300°C and not greater than 1400°C, and a solidification temperature range which is not greater than 20°C.

11. A single crystal seed alloy composition as claimed in claim 1, wherein the further metal comprises tungsten in the range 5 to 50 weight %.

12. A single crystal seed alloy composition as claimed in claim 11, wherein the tungsten is present in the range 13 to 40 weight %.

13. An aluminum-free single crystal seed alloy composition consisting essentially of:

nickel; and,

tantalum in the proportion of 13 to 45 weight %,

wherein the alloy composition has a solidification temperature which is not less than 1300°C and not greater than 1400°C, and a solidification temperature range which is not greater than 20°C.

14. A single crystal seed alloy composition as claimed in claim 1, wherein the further metal comprises tantalum in the range 5 to 50 weight %.

15. A single crystal seed alloy composition as claimed in claim 14, wherein the tantalum is present in the range 13 to 50 weight %.

16. A single crystal seed alloy composition as claimed in claim 15, wherein the tantalum is present in the range 20 to 45 weight %.

17. A single crystal seed alloy composition as claimed in claim 16, wherein the tantalum is present in the range 25 to 35 weight %.

18. An aluminum-free single crystal seed alloy composition consisting essentially of:

nickel; and

tantalum in the proportion of 25 to 35 weight %,

wherein the alloy composition has a solidification temperature which is not less than 1300°C and not greater than 1400°C, and a solidification temperature range which is not greater than 20°C.

19. An aluminum-free single crystal seed alloy composition consisting essentially of:

nickel; and

tungsten in the proportion of 5 to 50 weight %.

20. An aluminum-free single crystal seed alloy composition consisting essentially of:

nickel; and

tungsten in the proportion of 13 to 40 weight %.